COL724 Assignment – 3 Report

Part 1 – Controller Hub and Learning Switch

- **Latency**

```
ininet> h2 ping h5 -c 3
PING 10.0.0.42 (10.0.0.42) 56(84) bytes of data.
64 bytes from 10.0.0.42: icmp_seq=1 ttl=64 time=7.00 ms
64 bytes from 10.0.0.42: icmp_seq=2 ttl=64 time=7.68 ms
64 bytes from 10.0.0.42: icmp_seq=3 ttl=64 time=6.80 ms

-- 10.0.0.42 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
tt min/avg/max/mdev = 6.799/7.159/7.684/0.379 ms
```

```
mininet> h2 ping h5 -c 3
PING 10.0.0.42 (10.0.0.42) 56(84) bytes of data.
64 bytes from 10.0.0.42: icmp_seq=1 ttl=64 time=7.73 ms
64 bytes from 10.0.0.42: icmp_seq=2 ttl=64 time=0.303 ms
64 bytes from 10.0.0.42: icmp_seq=3 ttl=64 time=0.267 ms

--- 10.0.0.42 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2010ms
rtt min/avg/max/mdev = 0.267/2.767/7.732/3.510 ms
```

The difference between hub controller and learning switch is that hub controller floods every time a packet is received, whereas a learning switch installs rules learned on the basis of source and destination mac address matching when it floods for the first time. Therefore, on the next ping it takes less time

Throughput

Controller Hub
33 Mb/s

Learning Switch

```
mininet> iperf h1 h5
*** Iperf: testing TCP bandwidth between h1 and h5
*** Results: ['98.5 Gbits/sec', '98.4 Gbits/sec']
```

Rules on switches

Controller Hub

```
*** s1 ------------------------------------------------------------------------
 cookie=0x0, duration=130.616s, table=0, n_packets=257, n_bytes=21082, priority=0 actions=CONTROLLER:65535
*** s2 ------------------------------------------------------------------------
 cookie=0x0, duration=130.623s, table=0, n_packets=257, n_bytes=21082, priority=0 actions=CONTROLLER:65535
```

Learning Switch

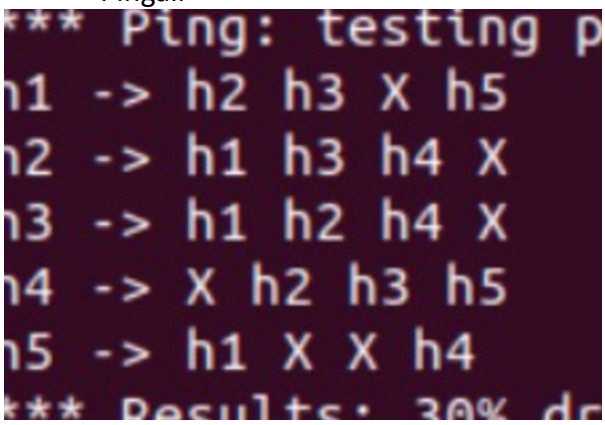
```
*** s1 ------------------------------------------------------------------------
 cookie=0x0, duration=73.743s, table=0, n_packets=3, n_bytes=238, priority=1,in_port="s1-eth2",dl_dst=fe:92:92:55:92:e2 actions=outp
ut:"s1-eth1"
 cookie=0x0, duration=73.739s, table=0, n_packets=2, n_bytes=140, priority=1,in_port="s1-eth1",dl_dst=ce:85:4e:0e:9c:1f actions=outp
ut:"s1-eth2"
 cookie=0x0, duration=73.732s, table=0, n_packets=3, n_bytes=238, priority=1,in_port="s1-eth3",dl_dst=fe:92:92:55:92:e2 actions=outp
ut:"s1-eth1"
 cookie=0x0, duration=73.730s, table=0, n_packets=2, n_bytes=140, priority=1,in_port="s1-eth1",dl_dst=8a:f5:02:99:2b:0b actions=outp
ut:"s1-eth3"
 cookie=0x0, duration=73.724s, table=0, n_packets=9, n_bytes=714, priority=1,in_port="s1-eth4",dl_dst=fe:92:92:55:92:e2 actions=outp
ut:"s1-eth1"
 cookie=0x0, duration=73.723s, table=0, n_packets=7, n_bytes=574, priority=1,in_port="s1-eth1",dl_dst=62:b9:81:f8:9a:af actions=outp
ut:"s1-eth4"
 cookie=0x0, duration=73.715s, table=0, n_packets=3, n_bytes=238, priority=1,in_port="s1-eth3",dl_dst=ce:85:4e:0e:9c:1f actions=outp
ut:"s1-eth2"
 cookie=0x0, duration=73.714s, table=0, n_packets=2, n_bytes=140, priority=1,in_port="s1-eth2",dl_dst=8a:f5:02:99:2b:0b actions=outp
ut:"s1-eth3"
 cookie=0x0, duration=73.710s, table=0, n_packets=6, n_bytes=476, priority=1,in_port="s1-eth4",dl_dst=ce:85:4e:0e:9c:1f actions=outp
ut:"s1-eth2"
 cookie=0x0, duration=73.708s, table=0, n_packets=4, n_bytes=336, priority=1,in_port="s1-eth2",dl_dst=62:b9:81:f8:9a:af actions=outp
ut:"s1-eth4"
 cookie=0x0, duration=73.686s, table=0, n_packets=6, n_bytes=476, priority=1,in_port="s1-eth4",dl_dst=8a:f5:02:99:2b:0b actions=outp
ut:"s1-eth3"
 cookie=0x0, duration=73.682s, table=0, n_packets=4, n_bytes=336, priority=1,in_port="s1-eth3",dl_dst=62:b9:81:f8:9a:af actions=outp
ut:"s1-eth4"
 cookie=0x0, duration=68.522s, table=0, n_packets=0, n_bytes=0, priority=1,in_port="s1-eth1",dl_dst=ae:99:0d:29:93:42 actions=output
:"s1-eth4"
 cookie=0x0, duration=58.537s, table=0, n_packets=0, n_bytes=0, priority=1,in_port="s1-eth2",dl_dst=ae:99:0d:29:93:42 actions=output
:"s1-eth4"
 cookie=0x0, duration=48.555s, table=0, n_packets=0, n_bytes=0, priority=1,in_port="s1-eth3",dl_dst=ae:99:0d:29:93:42 actions=output
:"s1-eth4"
 cookie=0x0, duration=85.348s, table=0, n_packets=75, n_bytes=7300, priority=0 actions=CONTROLLER:65535
*** s2 ------------------------------------------------------------------------
 cookie=0x0, duration=73.732s, table=0, n_packets=6, n_bytes=476, priority=1,in_port="s2-eth1",dl_dst=fe:92:92:55:92:e2 actions=outp
ut:"s2-eth3"
 cookie=0x0, duration=73.732s, table=0, n_packets=3, n_bytes=238, priority=1,in_port="s2-eth2",dl_dst=fe:92:92:55:92:e2 actions=outp
ut:"s2-eth3"
 cookie=0x0, duration=73.730s, table=0, n_packets=17, n_bytes=1442, priority=1,in_port="s2-eth3",dl_dst=62:b9:81:f8:9a:af actions=ou
tput:"s2-eth1"
 cookie=0x0, duration=73.719s, table=0, n_packets=4, n_bytes=336, priority=1,in_port="s2-eth1",dl_dst=ce:85:4e:0e:9c:1f actions=outp
ut:"s2-eth3"
 cookie=0x0, duration=73.719s, table=0, n_packets=2, n_bytes=140, priority=1,in_port="s2-eth2",dl_dst=ce:85:4e:0e:9c:1f actions=outp
ut:"s2-eth3"
 cookie=0x0, duration=73.700s, table=0, n_packets=4, n_bytes=336, priority=1,in_port="s2-eth1",dl_dst=8a:f5:02:99:2b:0b actions=outp
ut:"s2-eth3"
 cookie=0x0, duration=73.700s, table=0, n_packets=2, n_bytes=140, priority=1,in_port="s2-eth2",dl_dst=8a:f5:02:99:2b:0b actions=outp
ut:"s2-eth3"
 cookie=0x0, duration=68.528s, table=0, n_packets=2, n_bytes=84, priority=1,in_port="s2-eth3",dl_dst=ae:99:0d:29:93:42 actions=outpu
t:"s2-eth2"
 cookie=0x0, duration=85.355s, table=0, n_packets=56, n_bytes=5874, priority=0 actions=CONTROLLER:65535
```

To minimize the number of rules installed, we could store the mac address of s2 as destination instead of both h4, h5 on the switch s1. As right now we are going to forward to s2 only, and later s2 could forward accordingly.

If the new rules are independent from the existing ones, then assigning new ones with highest priority is sufficient.

Part 2 – Firewall and Monitor

- Pingall



Part 3 – Load Balancer

```
*** s1 ----------------------------------------------------------------------
 cookie=0x0, duration=23.881s, table=0, n_packets=1, n_bytes=98, priority=2,ip,nw_src=10.0.0.1,nw_dst=10.0.0.42 actions=CONTROLLER:6
5535
 cookie=0x0, duration=23.881s, table=0, n_packets=0, n_bytes=0, priority=2,ip,nw_src=10.0.0.2,nw_dst=10.0.0.42 actions=CONTROLLER:65
535
 cookie=0x0, duration=23.881s, table=0, n_packets=0, n_bytes=0, priority=2,ip,nw_src=10.0.0.3,nw_dst=10.0.0.42 actions=CONTROLLER:65
535
 cookie=0x0, duration=23.882s, table=0, n_packets=3, n_bytes=238, priority=1,in_port="s1-eth4",dl_dst=fe:92:92:55:92:e2 actions=outp
ut:"s1-eth1"
 cookie=0x0, duration=8.222s, table=0, n_packets=1, n_bytes=42, priority=1,in_port="s1-eth1",dl_dst=62:b9:81:f8:9a:af actions=output
:"s1-eth4"
 cookie=0x0, duration=31.736s, table=0, n_packets=49, n_bytes=4980, priority=0 actions=CONTROLLER:65535
*** s2 ----------------------------------------------------------------------
 cookie=0x0, duration=23.893s, table=0, n_packets=3, n_bytes=238, priority=1,in_port="s2-eth1",dl_dst=fe:92:92:55:92:e2 actions=outp
ut:"s2-eth3"
 cookie=0x0, duration=23.893s, table=0, n_packets=0, n_bytes=0, priority=1,in_port="s2-eth2",dl_dst=fe:92:92:55:92:e2 actions=output
:"s2-eth3"
 cookie=0x0, duration=23.891s, table=0, n_packets=2, n_bytes=140, priority=1,in_port="s2-eth3",dl_dst=62:b9:81:f8:9a:af actions=outp
ut:"s2-eth1"
 cookie=0x0, duration=31.746s, table=0, n_packets=41, n_bytes=4324, priority=0 actions=CONTROLLER:65535
```

```
Flow-Mod written to 0000000000000001
Flow-Mod written to 0000000000000001
routing 10.0.0.42 to h4 at mac address = 62:b9:81:f8:9a:af
Flow-Mod written to 0000000000000001
Flow-Mod written to 0000000000000002
routing 10.0.0.42 to h5 at mac address = ae:99:0d:29:93:42
Flow-Mod written to 0000000000000001
```

We could add session persistence, logging and monitoring the server health, and round robin with weighted distribution. This will result in a dynamic load balancer.